and the upper electrode pattern **144**. Alternatively, it is also possible that lower electrodes and upper electrodes facing each other are formed in a dot form on the lower substrate **110** and the upper substrate **120**, respectively.

[0059] FIG. **5** shows an example of a touch panel on which a button area is delimited by applying a driving voltage only to some combinations of driving electrodes. In the touch panel illustrated in FIG. **5**, in which a button area is delimited on the user contact surface of an upper substrate, a part to which a supply voltage is applied to form an electric field in electro-rheological fluid is delimited as a button area.

[0060] Referring to FIG. **5**, by applying an electric field only to driving electrodes (**140** in FIG. **4**B) that are arranged at locations corresponding to a designated location of a button (an alphabet "A" button) displayed on a display, the viscosity of electro-rheological fluid **130** in the corresponding area is sharply increased. In this way, if a button area is delimited on the touch panel using variation in viscosity of electro-rheological fluid, the button area may be sensed through tactile feel by a user. In the example illustrated in FIG. **5**, a user may sense that a portion (that is, a hard portion) having a high viscosity is a button on the touch panel. Accordingly, a tactile feedback function based on the texture of a touch panel may be implemented.

[0061] FIGS. **6**A and **6**B and FIGS. **7**A and **7**B show additional examples in which button areas are delimited respectively on user contact surfaces of upper substrates in the touch panel described above with reference to FIGS. **4**A and **4**B. Likewise, in the examples illustrated in FIGS. **6**A and **6**B, and FIGS. **7**A and **7**B, by making a portion of a touch panel hard while making the other portion soft, a button area is delimited on the user contact surface.

[0062] Referring to FIGS. **6**A and **6**B, no driving voltage is applied to driving electrodes corresponding to parts (③, ④ and ⑤) where a button "A" is displayed on a display, and a driving voltage is applied to driving electrodes corresponding to the peripheral parts (①, ②, ⑥ and ⑦) around the parts where the button "A" is displayed. Accordingly, the parts (③, ④ and ⑤) on which the button "A" is displayed become soft, and the peripheral parts (①, ②, ⑥ and ⑦) become hard. In the current exemplary embodiment, the touch panel parts (③, ④ and ⑤) in which electro-rheological fluid having a low viscosity exists are thus delimited as an input button area. Accordingly, when a user touches the touch panel illustrated in FIGS. **6**A and **6**B, a user may feel a relatively soft texture on the button area when pressing the "A" button.

[0063] Referring to FIGS. **7**A and **7**B, in this example, a driving voltage is applied only to driving electrodes corresponding to the edge portions (② and ⑥) around the parts where a button "A" is displayed on a display, and no driving voltage is applied to the parts (③, ④ and ⑤) where the button "A" is displayed or to the outer portions (① , ⑦) of the edge portions. The example illustrated in FIGS. **7**A and **7**B corresponds to the case where the touch panel parts (③, ④ and ⑤) surrounded by parts (② and ⑥) whose viscosity has been significantly increased are delimited as a button area, and FIGS. **7**A and **7**B are thus a modification of the example illustrated in FIGS. **6**A and **6**B. In FIGS. **6**A and **6**B, the viscosity of electro-rheological fluid is increased in the remaining parts (①, ②, ⑥ and ⑦) around the button area, whereas in FIGS. **7**A and **7**B, the viscosity of electro-rheological fluid is increased only at the immediate edge portions (② and ⑥) of the button area.

[0064] In the touch panel according to the embodiment illustrated in FIGS. **7**A and **7**B, the peripheral areas which are not the button input area are small, and the edge portion of the button area may be sensed through tactile sense. Hence, since a relatively large number of button areas may be delimited on the user contact surface and also buttons adjacent to each other can be identified through a tactile sensation, the touch panel according to the current embodiment can be usefully applied to applications where many buttons have to be displayed on a small-sized display, such as an application where Qwerty keys are displayed on a display of a mobile phone.

[0065] Also, in the touch panel illustrated in FIGS. **6**A and **6**B and FIGS. **7**A and **7**B, a repulsive force similar to that felt when pressing a mechanical keypad can be provided to a user. This repulsive force is provided due to the flow of electro-rheological fluid being restricted in the touched button area due to an increase in viscosity of the peripheral area of the touched button area. Also, the touch panel according to the embodiments illustrated in FIGS. **6**A and **6**B and FIGS. **7**A and **7**B may offer users a clicking sensation since the fluid in the touched button area abruptly moves to the peripheral areas when a driving voltage is cut off at that time when the gap between upper and lower substrates is reduced to or below a threshold thickness.

[0066] The touch panel according to the above-described embodiments functions as a general touch panel in usual use, for example, when an application not using any input is running or when the preceding stage of an application does not use any input. However, when figures, characters, symbols, etc. are input through the touch panel or when an icon is selected and an input signal is generated, the touch panel may function as a user interface. The touch panel according to the above-described embodiments functions as a general touch panel when no driving voltage is applied, and when a driving voltage is applied, the viscosity of the fluid inside the touch panel is locally increased due to an electrostatic force generated locally between upper and lower substrates, so that a button is formed on the touch panel.

[0067] The button may be formed on the entire area or a partial area of the touch panel, and the numbers, shapes, sizes, etc. of buttons are not limited. FIGS. **8**A to **8**D show various examples where button areas are configured respectively on touch panels, wherein in the examples, the buttons are provided in the forms of numeric keys, Qwerty keys, icon menus and menu bars, respectively. Referring to FIGS. **8**A through **8**D, if a user tries to select a specific application, for example, when a user tries to call, to input a message, to select a menu or to use the Internet, the entire area (the case of FIG. **8**C) or the partial area (the cases of FIGS. **8**A, **8**B and **8**D) represented as "A" on the touch panel is used as a user input part. The remaining area except for the area "A" may be used as a display to display characters, figures, etc. which are input. On the other hand, if no driving voltage is applied, the whole touch panel may be used as a display.

[0068] If the user presses a specific button and the user's input is recognized, the previous buttons are restored according to the type of application, and the next stage of the application or another application is executed so that another type of button is formed on the touch panel, or no button is formed to return the panel to acting as a general touch panel.

[0069] A number of exemplary embodiments have been described above. Nevertheless, it will be understood that various modifications may be made. For example, suitable results may be achieved if the described techniques are performed in